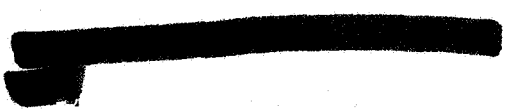
PREPRINT

MEDATA - A NEW CONCEPT IN MEDICAL RECORDS MANAGEMENT*

* This project was supported in part by the National Aeronautics and Space Administration Contract No. NSR 44-012-039 from the Manned Spacecraft Center.



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LEGEND OF ILLUSTRATIONS

Introduction

The potential applications for computers in expediting medical research and improving patient care are well recognized. However, in a medical environment full exploitation of the latent powers of available electronic devices depends on one vital factor. That is, giving the physicians, research scientists, or administrators direct control of the type of information acquired and stored, how it is related, and the timing of acquisition and retrieval. From the viewpoint of these professional users, the paramount goal is to achieve such direct control without sacrificing the valuable time and effort required to become experts in the esoteric art of computer programming and systems operation. This concept of immediate control was the basis for developing MEDATA, an amalgamation of techniques which allows the user to organize, collect, store, and retrieve all types of medical data without resorting to the intricacies of formal computer science.

Organization of Data

The MEDATA system does not specify the information structure but provides a framework for processing any structure required for the purposes of the user. Data are routinely collected on some form or questionnaire. Compilations such as abstracts in a library may not use printed forms, but the questions are implied by words such as Title, Author, Journal, and Abstract associated with the data.

Data on forms are usually related by headings and subheadings into a format resembling an outline. In the MEDATA

system selected typewriter symbols are used as prefixes to the questions or headings which express and preserve the relationships established by the user. A heading usually represents a broad classification of the questions following it, as illustrated in Figure I. Occasionally the heading will be additional information to be retrieved with each question, as in Figure II.

When forms are used, the answers can vary from a numeric quantity to English prose and are frequently a combination of these. The technique of enclosing quantitative or coded data in parentheses at the beginning of the answer permits expression of any type of answer. This gives the physician opportunity for unrestricted expression and the statistician opportunity to retrieve quantitative data.

Methods of Data Input

A programmed typewriter with an auxiliary paper tape is the input device. This procedure has several advantages. Unlimited numbers of characters may be used for entering data. The transcriber is the secretary, who is accustomed to using the information and is familiar with the notations and spelling. Coding sheets, which are laborious to prepare and proofread, are eliminated. The typed copy produced simultaneously with the data tape satisfies the legal requirements for preservation of a document signed by the physician.

The programmed typewriter is used to define the hierarchical structure for the questions as well as to enter the

data collected. To enter the format of a new data collection form into the system, the questions in their outline form are typed and simultaneously punched into a paper tape. This paper tape uniquely defines the collection form and is used to control the typewriter and paper tape punch each time data are collected on this questionnaire. The position of the question in the outline format is flagged by preceding it with one of the selected typewriter symbols. Questions may be grouped in subdivisions to nine levels. The typewriter characters selected to relate these subdivisions are referred to as position codes. These codes are $, #, @, *, ?, ¢, ↑, ', %. A colon (:) and typewriter programming codes are entered after each question requiring data. Figure I is an example of part of a laboratory collection form showing several levels of subdivisions.

Any headings or typewriter formatting characters, such as the name of the form or institution, can be entered preceding the first position code and will affect the appearance of the typed document but will not affect the storage and retrieval program. When the specific tape created for the form is used as a control tape, special headings are copied onto the typed document but not copied onto the paper tape being punched. Figure II is an example of a program tape used for medical summaries showing the outline headings and the position codes.

The position codes, the question, and the colon are

copied from the control tape to the new paper tape. The question and colon are typed on the document. If data are to be entered, the typewriter programming codes after the question will cause control to be transferred to the secretary. Data entered through the keyboard will appear on the document and will be punched into the new paper tape. Quantitative or coded data are enclosed in parentheses at the beginning of the entry. Any parentheses after the first character of the data are assumed to be part of the prose data. Figures III and IV are medical summaries collected using this procedure.

This subsystem for data collection has been formally titled STAT for systematized terminal acquisition technique and is being prepared in detail for publication.[13]

Storage of Data

The method of storing data on the mass storage medium departs radically from current data handling techniques. Both the question and its answer are stored for each set of data. This is an extravagant use of storage facilities, but it allows extreme flexibility, which is the primary objective. If the question precedes each answer, the information may be retrieved by restating the question and doing a phrase search of the mass memory. Any question can be added to the system by inserting it on the tape controlling the typewriter. No changes are required in the storage or retrieval programs. The physician and his secretary have complete control. Facsimile storage, or FACS, as this data management concept is called, will be discussed in detail elsewhere.[7]

Retrieval of Data

Extraction of pertinent data from the file is as flexible as the storage of the data. The terminal typewriter or card reader is used for medical requests based on four questions: WHO?, WHAT?, WHEN?, I/O?.

WHO? may be the patient's name or ID number for medical records or the author's name for library purposes. If more than one name is required, they can be entered in a series separated by semicolons. If selected data are to be retrieved for every name in the file, the request is answered by the word "ALL."

WHAT? may have answers ranging from one item to a complete medical record. If a complete record is required, the name of that record is entered. A single item or group of items can be retrieved by entering the name of the record, a hyphen, and the name of the item or group to be retrieved. Figure V illustrates the information retrieved by a request for all summary information on a patient. SUM is the name of the record of MEDICAL SUMMARY data. If a common item is to be retrieved from several records with different names, such as the diagnoses from all hospital records for the patient, the question is answered ALL-DIAGNOSIS. Figure VII shows how an item of information can be retrieved from charts originating in several unrelated offices with no limitations imposed on any of the offices. If selected records are to be retrieved depending on content, the question is answered by the name of

the record, hyphen (-), the question, colon (:), and the required series of symbols. Figure VI shows the selection of the chart with a specified phrase in the diagnosis.

The user-designed system of headings and subheadings has a particular advantage in handling medical data. For example, if information on eyes is requested, the data are returned with all superior and inferior headings--pupils belonging to eyes, under the major title, head. This is necessary for questions like WBC (white blood cells or count) which may be found in blood, serum, urine, etc. Data on WBC are retrieved with all the headings under which it appears. Figure VIII shows the retrieval of an item and its identifiers from several sections of the chart shown in Figure I. LAB is the record name for the LABORATORY SCREENING TESTS.

WHEN? may be a specific date, a series or range of dates, or all dates. Figures V, VI, VII, VIII illustrate this.

I/O is the choice of the available output units: TYPEWRITER, PRINTER, MAGNETIC TAPE, or DISK depending on the application and availability.

This data storage and retrieval system can be used as a FORTRAN subroutine in developing the data tapes for more elaborate tabular or mathematical statistical manipulations which users may wish to undertake with existing packaged statistical programs. Of course, special programming is required, but the task is more than half finished when the

data are available in computer-readable form. A complete description of this natural inquiry language for retrieval is in preparation.[14]

Computer Requirements

Computer requirements for the system are minimal. The system is written in an extremely basic FORTRAN using only READ, WRITE, DO statements, GO TO statements, computed GO TO statements, arithmetic IF statements, arithmetic statements, and COMMON. All communications between subroutines are done through COMMON to achieve maximum speed and minimum core requirements. As real-time multiterminal monitors become available, the FORTRAN program can be modified to accept requests from terminals.

MEDATA was developed using an SDS 930 with a console typewriter and magnetic tapes for storage. An IBM 1050 is the programmed typewriter used in this system.

Plans for Use of MEDATA Concepts

The system is being used for processing medical data on the astronauts at NASA Manned Spacecraft Center, Houston, Texas. The basic techniques are applicable for literature storage and retrieval, administrative records, and many other automated data processing requirements of a medical institution. Currently, the MEDATA methodology is being adopted for storage and retrieval of all personnel data for the staff of The University of Texas M. D. Anderson Hospital and Tumor Institute. Preliminary demonstrations have been conducted as the first step toward applying MEDATA techniques

for all medical records in the institution.

The system has received enthusiastic support from the professional staff using the techniques and those who have participated in demonstrations. The operations are quickly assimilated by persons with no background in computer science, and the users appreciate a sense of full control.

Secretarial or clerical personnel were easily and rapidly trained to create basic master tapes from the medical records and insert initial data as well as add subsequent observations. The only prerequisites are familiarity with mechanical operation of the programmed typewriter and reasonable typing skill. Typographic errors are quickly corrected by deleting incorrect entries and typing the correct information. Querying the computer using the WHO, WHAT, WHEN, I/O technique can be accomplished by anyone--typist or not--after five minutes of training. Neither the physician nor the typist needs to learn a new language to use the computer.

Discussion

The pattern of progress in applying computer sciences to everyday problems may be likened to the pattern of growth in an Airdale puppy. Each extremity seems to develop independently, and not until maturity is reached does the beast present an appearance of functional integrity. The advent of time-sharing technology is focusing increasing attention on the most retarded extremity of computer science--

providing the unsophisticated user access to computer power. For the concept of time-sharing to realize its full potential, the computer must become a functioning part of the user's environment. The capabilities of computer connected terminals are multifold and include not only the control of central computer analyses and communication facilities but also provide significant improvements in data collection and retrieval options. The developments reported here explore the integration of new ideas and available equipment to produce a user-oriented medical data collection, storage, and retrieval system.

During the conception and embryogenesis of MEDATA, a concerted effort was made to utilize the applicable published ideas in the field. The integration of a terminal into the system for acquisition and retrieval of data by the medical user has been employed by others.[2, 10, 15] The advantages of direct input by the secretarial personnel through a programmed typewriter terminal was adopted by the National Library of Medicine MEDLARS activity,[1] and elsewhere.[12] User-oriented data organization and variable field structuring are features of several medically-oriented systems,[4, 6, 8, 9, 11] and the user-oriented retrieval language (Who, What, When) was first published by our own group a year ago.[5] The amalgamation of these approaches to the various facets of medical records automation resulted in MEDATA, which offers new dimensions to the field.

Summary

MEDATA, an automated medical records system, represents an organized approach to the collection, storage, and retrieval of medical data. This completely user-oriented system takes advantage of the background and training of the medical secretary and simultaneously by-passes the conventional keypunch operators and coders. It is capable of responding directly (in his own terminology) to the user who lacks extensive computer background. The system is inexpensive to maintain, and the programs and basic system concepts are machine independent.

BIBLIOGRAPHY

1. Austin, C. J.: Data Processing Aspects of MEDLARS. Bull. Med. Libr. Assn. 52(1):159-163, 1964.

2. Barnett, G. O., and Castleman, P. A.: A Time-Sharing Computer System for Patient-Care Activities. Computers and Biomedical Research. 1(1):41-50, March 1967.

3. College of American Pathologists, Committee on Nomenclature and Classification of Disease: Systematized Nomenclature of Pathology (SNOP). Chicago, Illinois, 1965.

4. Dreyfus, R. H., Nettleton, W. J., Jr., and Sweeney, J. W.: Tulane Information Processing System--Version II. Tulane Univ. Comp. Sci. Series. Monograph Number 3, 1966.

5. Farley, W. F., Pulido, A. H., Minckler, T. M., and Cady, L. D., Jr.: Man-Machine Communications in the Biological-Medical Research Environment. Proc. 21st Nat. ACM Conf. Assoc. for Computing Machinery. pp. 263-267, 1966.

6. Hall, C., Mellner, C., and Danielsson, T.: A Data Processing System for Medical Information. Meth. Info. Med. 6(1):1-6, 1967.

7. Horton, C. L., and Minckler, T. M.: The Automation of Medical Records. II. Facsimile Storage Technique (FACS). (In preparation)

8. Korein, J., Goodgold, A. L., and Randt, C. T.: Computer Processing of Medical Data by Variable-Field-Length Format. II. Progress and Utilization of the Technique. N. Y. Univ. Med. Cent. pp. 1-16, June 1965.

9. Lamson, B. G., Glinski, B. C., Hawthorne, G. S., Soutter, J. C., and Russell, W. S.: Storage and Retrieval of Uncoded Tissue Pathology Diagnoses in the Original English Free Text Form, Appendix A. In User's Manual I - A Natural Language Information Retrieval System. IBM Data Processing Division of Los Angeles Scientific Center. November 1966.

10. Lauler, L. J., and Fuller, W. D.: The Lockheed Hospital Information System. Fifth Annual Symposium on Biomathematics and Computer Science in the Life Sciences, Houston, Texas (abstract). pp. 70-74, 1967.

11. Lusted, L. B.: Primate Record Information Management Experiment (P.R.I.M.E.). Oregon Regional Primate Research Center. 1966.

12. Minckler, T. M., Ausman, R. K., Graham, T., Newell, G. R., and Levine, P. H.: HUMARIS - An Automated Medical Data Management System. Meth. Info. Med. 6(2):65-69, April 1967.

13. Minckler, T. M., and Horton, C. L.: The Automation of Medical Records. I. Systematized Terminal Acquisition Technique (STAT). (In preparation)

14. Minckler, T. M., and Horton, C. L.: The Automation of Medical Records. III. Natural Inquiry Language (NIL). (In preparation)

15. Slack, W. V., Peckham, B. M., Van Cura, L. J., and Carr, W. F.: A Computer Based Physical Examination System. J.A.M.A. 200(4):224-228, 1967.

```
$CLIN PATH
     #CBC
          @Hb:
          @WBC:
          @MORPH
               *RBC:
               *WBC:
               *PLATELETS:
     #UA
          @pH:
          @Sp Gr:
          @Alb:
          @MICRO
               *RBC:
               *WBC:
               *BACT:
$X-RAY
```

Figure 1 - Sample Program Tape

W H A L E R S H O S P I T A L

New Bedford, Massachusetts

MEDICAL SUMMARY

$ID NO:

$NAME:

$DATE:

$PURPOSE OF EXAM:

#PRESENT ILLNESS:

#DIAGNOSIS:

#TREATMENT:

#COMMENTS:

$EXAMINING FACILITY:

$PHYSICIAN:

Figure II - Program Tape for Medical Summary

W H A L E R S H O S P I T A L

New Bedford, Massachusetts

MEDICAL SUMMARY

ID NO:	12345
NAME:	Mobius, Richard
DATE:	14Dec66
PURPOSE OF EXAM:	Medical Complaint--Limp
PRESENT ILLNESS:	Several years ago noticed severe limp after ocean voyage. PE shows absense of left lower extremity.
DIAGNOSIS:	(Y902-4991-0000)* Traumatic amputation (whale bite) left lower leg, old.
TREATMENT:	Tender loving care
COMMENTS:	Continue follow-up
EXAMINING FACILITY:	Whalers Hospital, New Bedford, Mass.
PHYSICIAN:	David Jones, M.D.

Underlined words were typed automatically by programmed typewriter under the control of the program tape described in Figure II.

*SNOP coding:[3]

Topography	Y920	Lower left extremity
Morphology	1472	Traumatic amputation complete
Etiology	4991	Whale
Function	0000	Not applicable

Figure III - Medical Summary-14Dec66

W H A L E R S H O S P I T A L

New Bedford, Massachusetts

MEDICAL SUMMARY

ID NO:	12345
NAME:	Mobius, Richard
DATE:	01Jan67
PURPOSE OF EXAM:	Medical Complaint "not feeling well, Doc"
PRESENT ILLNESS:	About 3 hours following consumption of one-half barrel spiced Jamaican rum, patient noticed onset of blurred vision, occasional dizziness, nausea, and acute heartburn. Exam showed elderly white male in minor distress without significant physical findings.
DIAGNOSIS:	(0000-0000-0000-7236)* Acute overdose of spices
TREATMENT:	Gelucil PRN Advised patient to use unspiced rum in future.
COMMENTS:	Return for follow-up one week.
EXAMINING FACILITY:	Whalers Hospital, New Bedford, Mass.
PHYSICIAN:	David Jones, M.D.

Underlined words were typed automatically by programmed typewriter under the control of the program tape described in Figure II.

*SNOP coding:[3]

Topography	0000	Not applicable
Morphology	0000	Not applicable
Etiology	0000	Not assigned (Spices)
Function	7236	Food intolerance

Figure IV - Medical Summary-01Jan67

```
WHO     12345.  MOBIUS, RICHARD.
WHAT    SUM-PURPOSE OF EXAM.
WHEN    ALL.
I/O     TYPE.

12345          MOBIUS, RICHARD          14DEC66
MEDICAL SUMMARY
   PURPOSE OF EXAM:      MEDICAL COMPLAINT--LIMP
      PRESENT ILLNESS:   SEVERAL YEARS AGO NOTICED SEVERE LIMP
                         AFTER OCEAN VOYAGE.  PE SHOWS ABSENCE
                         OF LEFT LOWER EXTREMITY.
      DIAGNOSIS:         (Y902-1472-4991-0000) TRAUMATIC AMPUTATION
                         (WHALE BITE) LEFT LOWER LEG, OLD.
      TREATMENT:         TENDER LOVING CARE
      COMMENTS:          CONTINUE FOLLOW-UP


12345          MOBIUS, RICHARD          01JAN67
MEDICAL SUMMARY
   PURPOSE OF EXAM:      MEDICAL COMPLAINT "NOT FEELING WELL,
                         DOC"
      PRESENT ILLNESS:   ABOUT 3 HOURS FOLLOWING CONSUMPTION
                         OF ONE-HALF BARREL SPICED JAMAICAN
                         RUM, PATIENT NOTICED ONSET OF BLURRED
                         VISION, OCCASIONAL DIZZINESS, NAUSEA,
                         AND ACUTE HEARTBURN.  EXAM SHOWED
                         ELDERLY WHITE MALE IN MINOR DISTRESS
                         WITHOUT SIGNIFICANT PHYSICAL FINDINGS.
      DIAGNOSIS:         (0000-0000-0000-7236) ACUTE OVERDOSE
                         OF SPICES
      TREATMENT:         GELUCIL PRN
                         ADVISED PATIENT TO USE UNSPICED RUM
                         IN FUTURE.
      COMMENTS:          RETURN FOR FOLLOW-UP ONE WEEK.
```

Figure V - Purpose of Exam Retrieved

```
WHO       ALL.
WHAT      SUM-DIAGNOSIS:  WHALE BITE.
WHEN      01DEC66 - 28FEB67.
I/O       TYPE.

12345          MOBIUS, RICHARD          14DEC66
MEDICAL SUMMARY
   PURPOSE OF EXAM:  MEDICAL COMPLAINT--LIMP
   DIAGNOSIS:        (Y902-1472-4991-0000) TRAUMATIC AMPUTATION
                     (WHALE BITE) LEFT LOWER LEG, OLD.
```

Figure VI - Diagnosis Retrieved

```
WHO       MOBIUS, RICHARD.
WHAT      ALL-DIAGNOSIS.
WHEN      01JAN67 - 28FEB67.
I/O       TYPE.

12345          MOBIUS, RICHARD          03FEB67
DENTAL REPORT
   DIAGNOSIS:      GUMS AND REMAINING TOOTH HEALTHY.

12345          MOBIUS, RICHARD          28FEB67
EYE EXAMINATION
   DIAGNOSIS:      POOR EYES, MAY CHASE WHALES WITH GLASSES ONLY.

12345          MOBIUS, RICHARD          01JAN67
MEDICAL SUMMARY
   DIAGNOSIS:      (0000-0000-0000-7236) ACUTE OVERDOSE
                   OF SPICES.
```

Figure VII - Diagnosis Retrieved

```
WHO       MOBIUS, RICHARD
WHAT      LAB-WBC.
WHEN      06MAR67.
I/O       TYPE.


12345              MOBIUS, RICHARD              06MAR67
LABORATORY SCREENING TESTS
   CLINICAL PATH
      CBC
         WBC:  10,200
         MORPH
            WBC:  NORMAL
      UA
         MICRO
            WBC:  NEGATIVE
```

Figure VIII - WBC Retrieved

CURRICULUM VITAE

DATE: June 30, 1967

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MARITAL STATUS:	Married on June 19, 1956 - Barbara Jean Scarff
CHILDREN:	Five

EDUCATION:

1951-55	B.A., Reed College, Portland, Oregon Biology
1955-59	M.D., University of Oregon Medical School, Portland, Oregon
1959-60	Internship (General Rotating) Jackson Memorial Hospital, Miami, Florida
1960-61	Pathology Residency, Jackson Memorial Hospital, Miami, Florida (W. A. D. Anderson, M. D.)
1961-63	Pathology Residency, General Rose Memorial Hospital, Denver, Colorado (Jeff Minckler, M.D., Ph.D.)
1963-64	Residency Credit, USPHS, National Cancer Institute, Washington, D.C.

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LICENSURE:

1960	Certified National Board of Medical Examiners
1960	State of Florida (Inactive)
1963	State of Colorado
1965	State of Texas

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June 1963 to July 1965	Surgeon (Lt. Commander), United States Public Health Service
June 1963 to January 1964	Pathologist, Tissue Pathology Unit, Virology Research Resources Branch, National Cancer Institute, National Institutes of Health, Washington, D. C.
January 1964 to July 1965	Head, Tissue Pathology Unit (Human Tissue Procurement Program) Virology Research Resources Branch National Cancer Institute, National Institutes of Health, Washington D. C.
July 1965 to present	Assistant Pathologist, Section of Experimental Pathology, Department of Pathology; Medical Systems Analyst, Department of Biomathematics; Assistant Professor of Pathology, The University of Texas M. D. Anderson Hospital and Tumor Institute, Houston, Texas
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SCIENTIFIC AND PROFESSIONAL ORGANIZATIONS:

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Society for Cryobiology (Founding Member)
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SCIENTIFIC AND PROFESSIONAL ORGANIZATIONS: (Cont.)

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Post Graduate Medical Assembly of South Texas
Texas Medical Association
Academic Clinical Laboratory Physicians and Scientists
American Medical Writers Association

COMMITTEE ACTIVITIES:

Local: Member- Scientific Advisory Council for the Common Research Computer Facility, Texas Medical Center, Houston, Texas

Member- Medical Records Committee, The University of Texas M. D. Anderson Hospital and Tumor Institute, Houston, Texas

National: Member- Committee on Computer Technics in Laboratory Medicine of the American Society of Clinical Pathologists

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SPECIAL INTERESTS:

Development of medical information systems, especially pathology data automation
Application of computers to medical problems
Utilization of human tissues for research and patient care
Clinical and anatomical pathology
Cryobiology
Medical records

CONTRACT AND GRANT ACTIVITY:

1965-1967 NASA Contract, NSR-44-012-039, Co-Principal Investigator with Lee D. Cady, Jr, M.D., Dr. P.H., "Installation of MEDATA/I at the National Aeronautics and Space Administration's Manned Spacecraft Center, Houston, $115,000.00

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CONTRACT AND GRANT ACTIVITY: (Cont.)

1966-1967	NCI Contract, PH43-66-937, Project Co-Director with Carl F. Tessmer, M.D., "Procurement of Serum from Advanced Cancer Cases," $36,815.00
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1965-1966	NCI Grant, CA09724-05, Consultant, "Trace Metal Patterns in Normal and Malignant Tissue."

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July 25, 1966
"Medical Record Automation," Clinical Pathology Seminar, M.D. Anderson Hospital.

September 15, 1966
"Copper Studies of the Serum of Leukemia Patients," Chemotherapy Seminar, M.D. Anderson Hospital.

November 21, 1966
"IBM 1050 Applications in Medical Automation," Conference for IBM salesmen, Houston, Texas.

November 28, 1966
"Medical Record Automation," Clinical Pathology Seminar, M.D. Anderson Hospital.

December 16, 1966
"Computers in the Automated Laboratory," School of Medical Technology, M.D. Anderson Hospital.

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"Medical Information Management Systems," Clinical Pathology Seminar, M.D. Anderston Hospital.

I N V I T E D P R E S E N T A T I O N S

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October 17, 1965
"The Cadaver: A National Resource." Annual Meeting of the American Society of Clinical Pathologists and College of American Pathologists in Chicago, Illinois.

November 3, 1965
"Cryobiology in Medicine - A Survey." 59th Annual Meeting of the Southern Medical Association in Houston, Texas.

September 22, 1966
"Post Mortem Bacteriology: A Practical Method for Routine Use." Annual Meeting of the American Society of Clinical Pathologist and College of American Pathologists in Washington, D. C.

October 26, 1966
"Laboratory Automation--A Perspective." Regular meeting of the Houston Society of Clinical Pathologists, Houston, Texas.

March 31, 1967
"MIMS - A User Controlled Medical Information Management System." Fifth Annual Symposium on Biomathematics and Computer Science in the Life Sciences, Houston, Texas.

April 27, 1967
"Medical Information Management Systems." Computers and Medicine Conference, University of Oregon Medical School, Portland, Oregon.

B I B L I O G R A P H Y

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1 Minckler, Tate M., Guy R. Newell, William F. O'Toole. A Cryogenic Shipping Container for Wet or Dry Ice Temperatures. Cryobiology, Vol. 2, No. 2, pp. 83-86, September-October, 1965.

2 Minckler, Tate M., William F. O'Toole, Guy R. Newell, Gen Niwayama, Paul Levine. Microbiology Experience in Collection of Human Tissue. Amer. J. Clin. Path., Vol. 45, No. 1, pp. 85-92, January, 1966.

3 Minckler, Tate M., Guy R. Newell. The Cadaver: A National Resource. Bull. Coll. Amer. Path., Vol. XX, No. 2, pp. 49-51, February, 1966.

4 Newell, Guy R., Tate M. Minckler, Mary L. McCrackan. Cryobiology in Medicine - A Survey. Southern Med. J., Vol. 59, No. 9, pp. 1023-1025, September, 1966.

*5 Farley, W. E., Alfred H. Pulido, Tate M. Minckler, Lee D. Cady. Man-Machine Communications in The Biological-Medical Research Environment. Proc. 21st Nat. ACM Conf. Assoc. for Computing Machinery, pp. 263-267, 1966.

6 Minckler, Tate M., E. Boyd. Physical Growth of the Nervous System and Its Coverings. Chapter in Neuropathology. Edited by Jeff Minckler, M.D., Ph.D., McGraw-Hill New York, N. Y. (In Press)

7 Minckler, Tate M., Robert K. Ausman, Guy R. Newell, Paul H. Levine, Thomas Graham. HUMARIS: An Automated Medical Data Management System. Meth. Info. Med., Vol. 6, No. 2, pp. 65-69, April, 1967.

8 de Jongh, D. S., J. W. Loftis, G. S. Green, J. A. Shively, T. M. Minckler. Post Mortem Bacteriology: A Practical Method for Routine Use. Amer J. Clin. Path. (In Press). Abstracted in Amer. J. Clin. Path., Vol. 47, No. 3, p. 370, March 1967.

*9 Minckler, T. M. MEDATA: An Automated Medical Information System. Chapter in NASA Publication. Edited by Jeff Lindsey, Ph.D. (In Preparation)

10 Cady, L. D., Jr., T. M. Minckler, C. L. Horton, B. A. Mitchell, Jr. Hospital Automation for Information About Circulation and Other Systems. 7th International Conference on Medical and Biological Engineering, Stockholm, 1967. (In Press)

*11 Horton, Caroline, T. M. Minckler. MEDATA - A New Concept in Medical Records Management. Proceedings of Fall Joint Computer Conference, 1967. (In Press)

12 Hrgovcic, Martin, Carl F. Tessmer, Tate M. Minckler, Benjamin Mosier, Grant H. Taylor. Serum Copper Levels in Lymphoma and Leukemia, with Special Reference to Hodgkin's Disease. Cancer. (In Press)

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HOME ADDRESS:	2415 Mimosa, G-3, Houston 19, Texas Area code 713-523-2410
OFFICE ADDRESS:	The University of Texas, M. D. Anderson Hospital and Tumor Institute, Houston, Texas 77025 Area code 713-529-4311, Extension 451
MARITAL STATUS:	Single

EDUCATION:

1954-57	B.S., Lamar State College of Technology, Mathematics
1957	Florida State University, Graduate work in mathematics
1958-59	Rice University, graduate work in mathematics

WORK EXPERIENCE:

June 1966 to present	Computer Programmer IV, Section of Medical Information Management Systems, Department of Biomathematics, The University of Texas, M. D. Anderson Hospital and Tumor Institute, Houston, Texas
December 1965 to June 1966	Senior Scientific Programmer, Lockheed Electronics Company, Houston, Texas
August 1965 to December 1965	Programmer, Development Designers Inc., Norristown, Pennsylvania
May 1965 to August 1965	Programmer, Comprehensive Designers Inc., Philadelphia, Pennsylvania
August 1962 to May 1965	Aerospace Technologist, Computer Data Systems Analyst, NASA - MSC, Houston, Texas

CURRICULUM VITAE
Caroline Lee Horton

WORK EXPERIENCE:

November 1960 to August 1962	Systems Programmer, CEIR Inc., Houston, Texas
May 1959 to November 1960	Computer Systems Analyst, Hughes Tool Company, Houston, Texas
July 1957 to September 1958	Junior Mathematician, Mobil Oil Company, Beaumont, Texas

SPECIAL INTERESTS:

Real-time Computer Systems

INVITED PRESENTATIONS

March 31, 1967
"MIMS" - A User Controlled Medical Information Management System." Fifth Annual Symposium on Biomathematics and Computer Science in the Life Sciences, Houston, Texas.

B I B L I O G R A P H Y

Caroline Horton

1 Cady, L. D., Jr., T. M. Minckler, C. L. Horton, B. A. Mitchell, Jr. Hospital Automation for Information about Circulatory and Other Systems. 7th International Conference on Medical and Biological Engineering, Stockholm, 1967. (In Press)

*2 Horton, Caroline, T. M. Minckler. MEDATA - A New Concept in Medical Records Management. Proceedings of Fall Joint Computer Conference, 1967. (In Press)

CURRICULUM VITAE

DATE: June 26, 1967

NAME:	Annette Simons
PLACE AND DATE OF BIRTH:	Houston, Texas, [redacted]
SOCIAL SECURITY NUMBER:	[redacted]
HOME ADDRESS:	4023 Antoinette, Houston, Texas 77017 Area code 713-649-6493
OFFICE ADDRESS:	Department of Biomathematics, The University of Texas M. D. Anderson Hospital and Tumor Institute, Houston, Texas 77025 Area code 713-529-4311, Ext. 451
MARITAL STATUS:	Single
EDUCATION:	
1958-61	Diploma, Stephen F. Austin High School, Houston, Texas
1961-65	B.B.A. (Magna cum laude), Office Administration, University of Houston, Houston, Texas
July 1965	Certificat d'Assiduite, Universite de Poitiers, Tours, France
APPOINTMENTS:	
October 1965 to present	Statistician, Department of Biomathematics, The University of Texas M. D. Anderson Hospital and Tumor Institute, Houston, Texas
Summers 1963, 1964, 1965	Secretary in 1964, 1965, clerk-typist in 1963, Computing Sciences Section of the Mathematics Department, University of Houston, Houston, Texas
1961-62	Assistant to bookkeeper, Lone Star Supply, Company, Inc., Houston, Texas
1958-60	Assistant instructor, Byers and McDonald Dance Studio, Houston, Texas

CURRICULUM VITAE
Annette Simons

HONORS AND ORGANIZATIONS:

High School:	Graduated Magna cum laude; National Senior Honor Society--Corresponding Secretary; American Legion Award Club--Secretary, Treasurer; Green Masque Players, Order of Rainbow for Girls--Recorder
University:	Graduated Magna cum laude; Phi Kappa Phi and Beta Gamma Sigma National Honor Societies; French Club--Secretary

Scholarships:

1961-1963	Franklin Awards (#571)
Fall 1963	Alpha Delta Pi Award
Spring 1964	Franklin Award (#571)
1964-1965	Houston Chapter National Secretaries Association Scholarship

SPECIAL INTERESTS:

Computerization (Automation) of Records
Office Management

CURRICULUM VITAE

DATE: June 26, 1967

NAME:	Rose Mary Ostrom
PLACE AND DATE OF BIRTH:	San Antonio Texas, [redacted]
SOCIAL SECURITY NUMBER:	[redacted]
HOME ADDRESS:	9313 Tally Ho #134 Houston, Texas Area Code 713-484-5343
OFFICE ADDRESS:	Department of Biomathematics, The University of Texas M. D. Anderson Hospital and Tumor Institute, Area Code 713-529-4311, Ext. 451
MARITAL STATUS:	Married to James A. Ostrom, September 18, 1965

EDUCATION:

September 1957- May 1961	Diploma, Edgewood High School, San Antonio, Texas
September 1961- May 1962	Business Administration, San Antonio Jr. College, San Antonio, Texas
April 1966- January 1967	Diploma, 1401 Computer Programming, ECPI, Houston, Texas

APPOINTMENTS:

March 27, 1967 to present	Programmer (Acting) Department of Biomathematics, The University of Texas M. D. Anderson Hospital and Tumor Institute, Houston, Texas
April 1966- March 1967	Branch Secretary, NASA Manned Spacecraft Center, Houston, Texas
August 1, 1965- August 16, 1965	Bilingual Secretary, Agency for International Development, Washington, D. C.
July 1964- July 1965	Clerk-Stenographer, NASA Manned Spacecraft Center, Houston, Texas

CURRICULUM VITAE
Rose Mary Ostrom

APPOINTMENTS: (Cont.)

November 1962- July 1964	Clerk-Stenographer, SAAMA (SAPACE) Kelly AFB, Texas
September 1961- May 1962	Social Instructor, Madonna Neighborhood Center San Antonio, Texas

FOREIGN LANGUAGE:

Spanish (Fluent)

HONORS:

$100 College Scholarship
National Honor Society (Secretary)
Student Council (Secretary 2 years)
Certificates of Merit in Scholarship, Attendance, Shorthand, and Typing

CURRICULUM VITAE

DATE: June 26, 1967

NAME:	Janet I. Phillips Bardin
PLACE AND DATE OF BIRTH:	[redacted] Hollywood, California
SOCIAL SECURITY NUMBER:	[redacted]
HOME ADDRESS:	7104 Selma #10 Houston, Texas Area code 713-748-0511
OFFICE ADDRESS:	Department of Biomathematics, M. D. Anderson Hospital and Tumor Institute, 6723 Bertner Ave., Houston, Texas 77025 Area code 713-529-4311, Ext. 451
MARITAL STATUS:	Married

EDUCATION:

1961-1965	Diploma - Permian High School, Odessa, Texas
1965-1966	Odessa College, Odessa, Texas
1966-1967	University of Houston, Houston, Texas

APPOINTMENTS:

July 1966- January 1967	Greyhound Charter Office, Secretary
February 1967-	M. D. Anderson Hospital and Tumor Institute, Clerk Typist

HONORS:

National Honor Society, Permian High School
Dean's List, Odessa College
Phi Theta Kappa, Odessa College
Dean's List, University of Houston

SPECIAL INTERESTS:

English